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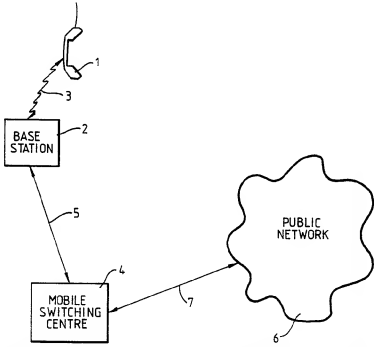
(54) Title: SPEECH SIGNAL TRANSMISSION

(57) Abstract

In the transmission of speech in mobile telephone services where mobile handsets co-operate with a base station via a radio link, the base station being connected to a mobile switching centre in turn connected to a public network, communication between the handsets and base stations is achieved using a standard selected to minimize bandwidth utilisation. Sample standards are GSM and DECT. It has currently been proposed that in utilising either of these standards a number of encoded speech channels will be multiplexed at the A interface between the base station and the MSC. The multiplex signal would then be converted to a 64 kb/s format at the interface between the MSC and the pulbic network to which the MSC is connected. This proposal has a number of disadvantages. To alleviate these disadvantages it is proposed that conversion to the 64 kb/s format should be avoided if the recipient node can reconstitute the speech directly from its encoded format and that to such recipient nodes the encoded speech is sent in packetised form.



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SPEECH SIGNAL TRANSMISSION

The present invention concerns the transmission of speech and is particularly concerned with mobile telephone services. The basic format for a network for mobile speech services will comprise the actual mobile handsets, a base station with which the handsets communicate via a radio link, a mobile switching centre (MSC) connected to the base station, and a public network, possibly including the PSTN, to which the MSC is connected. There will of course normally be many handsets associated with each base station, and each MSC will be linked to a number of base stations.

There has been an explosive growth in the provision of mobile telephone services in the U.K. and this growth is likely to be limited more by the available radio spectrum rather than by saturated demand. This is because telephone terminals are increasingly being connected to their respective networks by radio links. Whether the intention is to provide the user with unrestricted mobility (mobile service), or merely to give him the freedom of a restricted range of movement (cordless phone) the technical requirements have in common the need to restrict the use of bandwidth on the radio path in order to accommodate large numbers of users.

In an attempt to maximise the use of available bandwith

two emerging standards have been proposed. These standards are known respectively as GSM and DECT. GSM stands for Group Speciale Mobile and DECT stands for Digital European Cordless Telephony and is a standard being developed by ETSI.

GSM achieves its efficiency at the air interface by taking a short sample of speech and analysing it and then sending data which will allow this burst to be reconstituted. The DECT standard proposed by ETSI has a very similar format. It has currently been proposed that in utilising either of these two standards a number of encoded speech channels will be multiplexed at the A interface between the base station and the mobile switching centre (MSC). The multiplexed signal would then be converted to a 64 kb/s format at the interface between the MSC and the public network to which the MSC is connected.

There are a number of drawbacks to this proposal. Firstly in order to carry it out conversion equipment will be required at entry to and exit from the fixed network. This conversion equipment will almost certainly have to be from a common pool. Secondly there will be a time delay of around 100 ms per round trip due to the requirement for decoding and subsequent encoding. Thirdly the trunk network loses the bandwith advantage of the GSM coding.

The present invention is concerned with alleviating the above mentioned disadvantages.

Accordingly from a first aspect the present invention comprises a speech transmission network having a plurality of nodes where transmission between certain of the nodes is via a predetermined telephony standard, the network comprising a plurality of mobile stations capable of receiving and transmitting over radio links speech which has been analysed to provide data strings of a predetermined length from which the speech signal can be reconstituted, a base station for communicating with the mobile stations over the radio links and with a mobile switching centre, and wherein there is an interface between each base station and the mobile switching centre at which the individual data strings are

packetised for transmission across the communication network to another node without conversion to the predetermined telephony standard if the recipient node can reconstitute the speech directly from the data strings.

In accordance with a feature of the invention where the recipient node is not capable of reconstituting the speech from the data strings conversion to the predetermined telephony standard will be carried out at the most appropriate point in the data network.

In order that the present invention may be more readily understood Figure 1 of the accompanying drawings is a simple diagram showing the relationship between a cordless telephone and a public network.

Referring now to the single figure of the drawing, this shows a mobile station in the form of a cordless telephone 1 associated with a base station 2 over a radio link indicated at 3. The base station 1 is connected to a mobile switching centre (MSC) 4 via a link 5 and the mobile switching centre (MSC) 4 is in turn connected to a public network 6 via a link indicated at 7. It will be appreciated that the base station 2 is only one of several which would in normal instances be connected to the mobile switching centre 4. The public network 6 will have a plurality of nodes to which the speech data will be transmitted, and the MSC 4 provides one of these nodes. It is anticipated that the public network 6 will be at least partly capable of operating what is known as asynchronous transfer mode or ATM. In ATM capacity is allocated on demand to different users in fixed amounts called "cells". The emerging standard for this service specifies a payload of 48 bytes of information per cell.

For the purpose of the present description it will be assumed that communication between the cordless telephone 1 and the base station 2 utilises the standard known as GSM. This standard operates by taking a 20 ms sample of speech and analysing it to form data strings. Each of these strings is in the form of 267 bits (including Cyclic Redundancy Check bits (CRC)). Each such

string allows the short 20 ms burst of speech to be reconstituted. As already mentioned the current proposal for a GSM network is to multiplex a number of encoded speech channels at the A interface between the base station and the mobile switching centre and then to convert to a known telephony standard at the interface between the MSC and the public network 6. In the present embodiment this standard has a 64 kb/s format.

However the present invention proposes that since the speech data encoded in accordance with GSM is of a quantity and form that would fit comfortably into an ATM cell, the conversion to a continuous bit stream, and in particular the conversion to 64 kb/s format, should be performed only when the capabilities of the network to be used make it essential. This is in contra-distinction from what has already been proposed. Accordingly in the embodiment shown in Figure 1 the link 5 between the base station 2 and mobile switching centre 4 is operated as an ATM link and the data strings produced by the GSM coding are packetised into an ATM format. An advantage of this arrangement is that by using either add/drop multiplexers, or a metropolitan area network (MAN), preferably using DQDB protocol, a string of base stations such as base station 2 could all be connected very efficiently to the mobile switching centre.

It will also be appreciated that any operator of a mobile network will wish to maximise his handling of the traffic. Thus he will hand over calls destined for the fixed network as near as possible to the destination. Where both parties to a call are directly connected to his network he will obviously want to complete the whole call. Traffic of this kind will thus pass directly between linked mobile switching centres thus the proposal to avoid automatic conversion to a 64 kb/s format will enable this traffic to be handled efficiently in its GSM coded form for which ATM is eminently suitable. Where there are a number of different mobile operators it will be necessary for them to reach agreement to avoid unnecessary conversions to and from the 64 kb/s format and to use ATM bridges between their networks.

The proposal is particularly advantageous if a call from a mobile station can be recognised at call set-up time as terminating on another mobile. This would require a small addition to the repertoire of the emerging signalling standards. Thus where a GSM or other coded signal call is being set it will be necessary for the signalling protocol to identify the call as such. There are a number of very great advantages to be gained in keeping the speech in its encoded form throughout wherever this is possible.

(1) Avoiding the use of conversion equipment (from a common pool) at entry to and exit from the fixed network.

(2) Saving the time delay of a decode and subsequent encode (of the order of 100 ms round trip).

(3) Using only a fraction of the bandwidth on the trunk portion of the call.

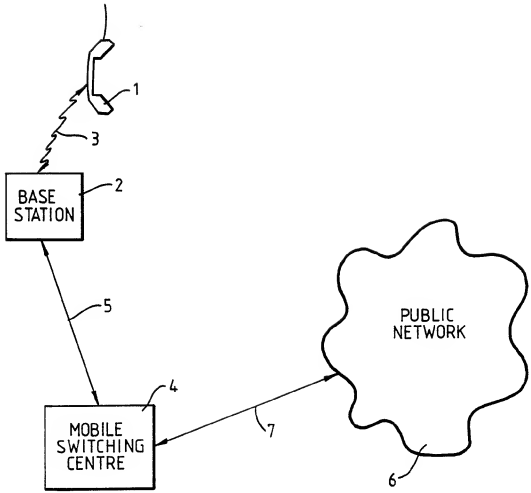
(4) Good fit to ATM infrastructure, without needing special measures to fill cells.

In general terms the advantages of the invention just described become particularly relevant when ATM has achieved good penetration in telephony networks and in particular the PSTN. It will also be appreciated that whilst the foregoing description has been given with regard to GSM coding of the original speech data that the present invention is equally applicable to DECT coding and for the purposes of this specification a DECT-standard cordless phone working to a suitable in-house base station counts as a mobile phone.

CLAIMS

1. A speech transmission network having a plurality of nodes where transmission between certain nodes is via a predetermined telephony standard, the network comprising a plurality of mobile statons capable of receiving and transmitting over radio links speech which has been analysed to provide data strings of a predetermined length from which the speech signal can be reconstituted, a base station for communicating with the mobile stations over the radio links and with a mobile switching centre, and wherein there is an interface between each base station and the mobile switching centre at which the individual data strings are packetised for transmission across the communication network to another node without conversion to the predetermined telephony standard if the receipient node can reconstitute the speech directly from the data strings.

2. A speech transmission network as claimed in Claim 1, where when the recipient node is not capable of reconstituting the speech from the data strings coversion to the predetermined telephony standard is carried out at the most appropriate point in the data network.


1
3
BASE STATION
2
5
PUBLIC NETWORK
4
MOBILE SWITCHING CENTRE
7
6

INTERNATIONAL SEARCH REPORT

PCT/GB 92/01131

Internatiooal Applicatioo No

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to Internatiooal Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 H04Q7/04; H04B7/26

II. FIELDS SEARCHED

Minimum Documeotation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	H04Q ; H04B

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Incluiied in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citatioo of Document,[11] with iodication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
A	41TH VEHICULAR TECHNOLOGY CONFERENCE May 1991, ST LOUIS US pages 326 - 332 PAUTET ET AL. 'GSM Protocol architecture: radio sub-system signalling' * paragraph: speech * see page 329, right column ---	1
A	BRITISH TELECOMMUNICATIONS ENGINEERING vol. 8, no. 2, July 1989, LONDON GB pages 14 - 19 ALTEHAGE 'Open Network Provision: Concepts and Technical Realisation Proposals for the Network of the Deutsche Bundespost Telekom' * paragraph: Structure of the D Network * see page 15 - page 16; figure 4 ---	1

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° Special categories of cited documents ;[10]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
09 OCTOBER 1992	19. 10. 92
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	JANYSZEK J.M.

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
P,X	WO,A,9 115 087 (PEITZ) 3 October 1991 see page 2, line 23 - line 31 see page 5, line 7 - page 6, line 4; figure -----	1,2

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. GB 9201131 SA 61604

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 09/10/92
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO-A-9115087	03-10-91	DE-A- 4008790	26-09-91
		AU-A- 7459691	21-10-91